



FEDERAL COMMUNICATIONS COMMISSION

47 CFR Part 73

[MB Docket No. 21-422; FCC 22-38; FR ID 89066]

FM Broadcast Radio Service Directional Antenna Performance Verification

AGENCY: Federal Communications Commission.

ACTION: Final rule.

SUMMARY: In this document the Federal Communications Commission (Commission or FCC) adopts changes to its rules and procedures for FM and Low Power FM (LPFM) broadcast license applicants to allow for verification of FM directional antenna patterns through computer models prepared by the directional antenna's manufacturer. The changes are designed to reduce the cost of designing and building an FM or LPFM directional antenna and, thus, of station construction. The changes are further designed to bring the Commission's rules for the FM and LPFM services into regulatory conformity with its rules governing AM and DTV directional antennas.

DATES: Effective [INSERT 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER], except for amendments to 47 CFR 73.316 and 73.1690, which are delayed indefinitely. The Commission will publish a separate document in the *Federal Register* announcing the effective date of these amendments.

FOR FURTHER INFORMATION CONTACT: Albert Shuldiner, Chief, Media Bureau, Audio Division, (202) 418-2721; Lisa Scanlan, Deputy Division Chief, Media Bureau, Audio Division, (202) 418-2704; Thomas Nessinger, Senior Counsel, Media Bureau, Audio Division, (202) 418-2709. For additional information concerning the Paperwork Reduction Act (PRA) information collection requirements contained in this document, contact Cathy Williams at 202-418-2918, or via the Internet at Cathy.Williams@fcc.gov.

SUPPLEMENTARY INFORMATION: This is a summary of the Commission's Report and

Order (R&O), MB Docket No. 21-422; FCC 22-38, adopted on May 19, 2022, and released on May 19, 2022. The full text of this document will be available via the FCC's Electronic Comment Filing System (ECFS), <https://www.fcc.gov/cgb/ecfs/>. Documents will be available electronically in ASCII, Microsoft Word, and/or Adobe Acrobat. Alternative formats are available for people with disabilities (braille, large print, electronic files, audio format), by sending an e-mail to fcc504@fcc.gov or calling the Commission's Consumer and Governmental Affairs Bureau at (202) 418-0530 (voice), (202) 418-0432 (TTY). The Commission published the notice of proposed rulemaking (NPRM) at 86 FR 67886 on November 30, 2021.

Paperwork Reduction Act of 1995 Analysis

This document contains new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13, see 44 U.S.C. 3507. The Commission, as part of its continuing effort to reduce paperwork burdens, will invite the general public and the Office of Management and Budget (OMB) to comment on the information collection requirements contained in the amendments to §§ 73.316 and 73.1690, in a separate Federal Register document, as required by the Paperwork Reduction Act of 1995, Public Law 104-13, see 44 U.S.C. 3507. These new or modified information collections will become effective after the Commission publishes a document in the *Federal Register* announcing such approval and the relevant effective date.

In addition, pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, see 44 U.S.C. 3506(c)(4), the Commission previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees.

Congressional Review Act

The Commission will send a copy of this R&O to Congress and the Government Accountability Office (GAO) pursuant to the Congressional Review Act, 5 U.S.C. 801(a)(1)(A).

Synopsis

1. *Introduction.* In the R&O, the Commission amended its rules to allow FM and LPFM broadcasters using directional antennas to employ computer modeling to verify the antennas' directional patterns. This represents a change from the current requirement, set forth in 47 CFR 73.316(c)(2)(iii), that an FM or LPFM directional antenna's performance be verified by the "measured relative field pattern," and brings the rules for those services into regulatory conformity with the rules governing AM and DTV directional antennas.

2. Four manufacturers of FM broadcast radio antennas and one licensee of FM broadcast stations (Joint Petitioners) filed a Petition for Rulemaking seeking to amend the Commission's rules to allow FM directional pattern verification by computer modeling. Currently, a permittee seeking to license a facility with a directional FM antenna system must provide verification that the directional pattern of the antenna conforms to what the Commission authorized in the construction permit. The applicant must submit, among other things, a plot of the composite pattern of the directional antenna, and a tabulation of the measured relative field pattern. The required tabulation and plot of the measured relative field pattern must be obtained either by building a full-size mockup of the antenna and supporting structures or by constructing a scale model of the antenna and structures on a test range or in an anechoic chamber. Joint Petitioners pointed out that FM radio is the only broadcast service that specifically requires stations using directional antennas to provide such physical measurements. Both the full- and scale-model measurement approaches, said Joint Petitioners, increase costs and are time-consuming. Joint Petitioners also pointed out a number of difficulties with physical measurement, such as problems in accurately replicating the installed antenna environment, including nearby structures that could affect the radiated pattern. A properly implemented computer model, according to Joint Petitioners, could take these factors into account, leading to a more accurate and less expensive pattern verification.

3. The Commission released the NPRM on November 15, 2021, FCC 21-117, in which it proposed to amend its rules to provide the option for verifying FM directional patterns

through computer modeling, and sought comment on the proposal, which would apply not only to license applications for new FM facilities, but to FM broadcast station licensees applying to license facility modifications. The Commission proposed, among other things, that the license applicant must provide the Commission with details of the software tools used in modeling the antenna's directional pattern and the process by which the computer modeling was carried out, as well as the qualifications of the engineer(s) who designed, modeled, and provided installation instructions for the directional antenna. The NPRM also posed several questions designed to determine whether and how best to implement a computer modeling standard. It asked whether there are easily obtainable physical measurements that can be used to verify the computer model's accuracy; whether there is a voluntary consensus standard or common computer model that antenna manufacturers and/or broadcast engineers agree provides the greatest accuracy; whether the most widely used directional FM antenna modeling software has a common theoretical basis that would allow Commission staff to evaluate the results generated by other software programs sharing the same theoretical basis; and how the staff should proceed in cases where there are interference complaints or other disputes as to the performance of a directional FM antenna that has been verified through a computer model (noting that such complaints are currently uncommon). Finally the NPRM sought general input regarding commenters' experiences with directional FM computer modeling software and its accuracy vis-à-vis real world performance.

4. *Discussion.* Several commenters that shared their experiences with computer modeling provided positive reports on the accuracy of computer models in depicting an antenna's directional pattern. The majority of the comments favored the proposal to amend the rules to allow computer modeling to verify FM directional antenna patterns as a means to provide license applicants with greater flexibility and to reduce overall costs for antenna manufacturers and broadcasters.

5. As discussed in more detail below, the Commission amended its rules to allow

license applicants for directional FM facilities to verify the directional antenna patterns by submitting results from computer models depicting the antenna's performance, as long as they are generated by the antenna's manufacturer. This modest rule change allows for similar treatment of FM and LPFM directional antenna performance verification and AM and DTV licensing, which do not preclude the use of computer modeling to verify directional antenna performance. This rule change will reduce the cost of designing and building an FM or LPFM directional antenna, savings that should be passed on to the broadcast applicant and thus reduce the cost of station construction. Additionally, a less expensive directional antenna should provide an FM or LPFM applicant with greater flexibility in antenna siting. As is explained below, the Commission also declined to adopt several of the proposals in the NPRM.

6. Based on strong record support that antenna manufacturers should be allowed to perform computer modeling of their products' directional patterns, the Commission updated 47 CFR 73.316, to provide license applicants with the option to submit either computer results generated by the antenna's manufacturer, or physical proof of antenna directionality pursuant to current practice. As one commenter stated, antenna manufacturers are in the best position to perform computer modeling of their own products because they have the historic data to know how a specific radiator performs in a particular environment. After reviewing the comments, as well as its rules and application procedures, the Commission was convinced that it can provide the intended regulatory relief for broadcasters and manufacturers with only this minimal change to its verification requirements. It further found that this change would achieve its goal of conforming the FM directional rules with similar rules governing AM and DTV stations (*see, e.g.,* 47 CFR 73.151 (AM directional antenna systems), 73.685(f) (DTV directional antennas)), while maintaining the integrity of its licensing requirements. It concluded that because antenna manufacturers are best positioned to provide license applicants with accurate and sufficient proofs of performance using computer models, it should amend its rules to provide license applicants with the option to submit a computer-modeled proof of performance on the condition

that such proof is provided to the licensee by the antenna manufacturer.

7. Under current Commission rules, when license applicants submit the showings required by 47 CFR 73.316(c)(2)(iii), they almost always rely on antenna manufacturer-supplied tabulations of the measured relative field pattern, performed either on a full-scale test range or with a scale model of the antenna. The Commission wished to continue to rely on the antenna manufacturer to validate directionality as it introduced the option for computer modeling. It agreed with commenters that the manufacturers are in the best position to ensure the validity of the computer model and the accuracy of the results. It also found that manufacturers have an incentive to represent accurately their products' performance, both to protect their own reputations and to avoid negative consequences for their customers who face interference complaints and regulatory action if their antenna patterns do not match what is authorized in their license. Because there was general agreement among commenters that antenna manufacturers have the expertise and knowledge of their products to be able to model the directional patterns effectively, and because the manufacturers already provide measured field patterns to their broadcast applicant/customers for submission to the Commission, it found that license applicants may submit computer-generated pattern verification from the antenna's manufacturer in lieu of measured relative field patterns, under the conditions set forth below. The Commission acknowledged commenter concern that manufacturer data should not be automatically accepted without a demonstration that the modeler has a background in physics or electromagnetic theory, and expected that any manufacturer would have an interest in providing models prepared by engineers possessing such expertise. However, given the varying backgrounds of broadcast engineers, the Commission did not wish to codify what constitutes qualifications to perform computer modeling. Should a challenge arise to a computer model, the Commission can and would seek further information regarding that model, including the qualifications of those preparing and performing the modeling.

8. The Commission declined to expand the range of entities authorized to perform

computer modeling of directional FM antenna patterns beyond manufacturers at this time. Although commenters largely agreed that license applicants should be able to rely on manufacturer computer modeling to verify FM directional patterns for that manufacturer's antennas, there was less agreement as to whether others should be allowed to perform computer modeling to verify FM directional antenna patterns. The Commission declined at this time to expand the range of entities authorized to perform computer modeling of directional FM antenna patterns beyond antenna manufacturers. While acknowledging that there are individuals and entities other than antenna manufacturers that are qualified to perform computer modeling of directional FM antenna patterns, the Commission elected at this point to rely on antenna manufacturers to perform computer modeling consistent with current industry practice. Although there is no such limitation on those who can perform computer modeling for AM and DTV directional antennas, it found a more cautious approach is required for FM, given the greater number of FM stations versus DTV stations using directional antennas, and given that AM directional patterns are subject to continual verification through sampling that is not possible with FM directional antennas. As more experience is gained with computer modeling of directional FM antenna patterns, the Commission will explore expanding the range of entities authorized to perform computer modeling beyond manufacturers.

9. Although the NPRM asked several questions about which software products should be used for computer modeling, the Commission declined to prescribe any particular modeling software that the antenna manufacturers must use, instead leaving this to the manufacturer's discretion. Commenters generally agreed that it should not dictate specific software products, for reasons ranging from concern about creating software monopolies or duopolies, to cost of software generally, to encouraging creation of new and better software products. Based on the comments, the Commission concluded that antenna manufacturers should have discretion to use either commercially available software products or their own proprietary software subject to the requirements set out below. Thus, if the license applicant's

submission includes modeled pattern predictions from a commercially available software program, the manufacturer's report need only identify it; if the antenna manufacturer generates results using custom software the manufacturer created or that was created for the manufacturer, the Commission will require a description of the software and the computational methods underlying the software sufficient to replicate the results if necessary.

10. As proposed in the NPRM, no matter which model or software is used, when a license application includes a proof of FM directional antenna performance obtained through computer modeling, the Commission will require that the application include a statement setting forth the name(s) and qualifications of the engineer(s) who designed the antenna, performed the modeling, and prepared the manufacturer's instructions for installing the antenna. The submission must also include a statement from such engineer(s) identifying and describing the software tools used in the model and the procedures used in running the software. It will also require a certification that the software executed normally without generating any error messages or warnings indicating something was wrong with the inputs. As proposed in the NPRM, and supported by commenters, such computer modeling must analyze the antenna mounted on a tower or tower section, and the tower or tower section model must include transmission lines, appurtenances, ladders, conduits, other antennas, and any other installations that could affect the computer modeled directional pattern. The submission statement must list and describe all such elements and structures included in the model.

11. The Commission also found sufficient reason to require verification of the accuracy of the pattern generated using a particular modeling software once for each directional antenna model number or standardized series of elements. Several commenters suggested that, once a directional antenna is modeled using a particular modeling software, a full-size or scale model of that antenna, or a single element thereof, should be constructed and the pattern measured in order to test the validity of the modeling method, with two of those commenters stating that once this process is completed for a particular antenna using a particular modeling

software, it need not be repeated unless the modeling method changes. The Commission agreed, and stated that in order to assist Commission staff in accuracy verification, the first time the directional pattern of a particular model of antenna is verified using a particular modeling software, it will require the license applicant to submit to the Commission both the results of the computer modelling and measurements of either a full-size or scale model of the antenna or elements thereof, demonstrating reasonable correlation between the measurements achieved and the computer model results. Once a particular antenna model or series of elements has been verified by any license applicant using a particular modeling software, the Commission will permit all subsequent license applicants using the same antenna model number or elements and using the same modeling software to submit the computer model for the subsequent antenna installation, and to cross-reference the original submission by providing the application file number. The Commission believed that this will provide a sufficient basis to verify that the computer model has been shown correctly to describe the pattern generated by the antenna or elements.

12. These changes, in combination with the Commission's existing requirement that the license applications include the tabulations and plot of the directional pattern prescribed in § 73.316, were deemed to be a sufficient basis for Commission staff to evaluate applications involving FM directional antennas. Applicants will be required to submit, as they do now, a statement from the engineer responsible for installing the antenna, certifying that the antenna has been installed pursuant to the manufacturer's instructions, and a statement from a licensed surveyor, verifying that the antenna is properly oriented.

13. In light of the record, the Commission did not change its current policies regarding interference complaints or disputes. In the NPRM, it asked whether its existing policies are sufficient to resolve any interference complaints or disputes pertaining to directional FM antennas. Most commenters agreed that interference was not and would not be a problem, and no changes to current interference rules and procedures were requested. One commenter,

which did not support computer modeling, contended that the proposed rule changes will increase FM interference due to modeled directional patterns that do not accurately reflect the actual directional signals. It also argued that this will increase inter-station interference disputes because full-service FM stations, unlike secondary services such as FM translators, need not cease operations upon receiving interference complaints. While acknowledging these concerns, the Commission stated that by requiring initial computer models of antennas and components using a particular modeling software to be verified by measurements, these concerns are sufficiently addressed.

14. The Commission found that its action provided the least disruptive means to update licensing of FM stations with directional antennas, while still allowing for the benefits of computer modeling set forth in the Joint Petition and the NPRM. It reiterated that the rule changes adopted are optional, and that applicants may still submit measured relative field patterns rather than computer modeled patterns if they so desire. The Commission finally found that the record did not provide sufficient support for further changes to its application procedures, nor does it support changes to our interference complaint and resolution policies, and therefore made no other changes to its rules at this time.

PROCEDURAL MATTERS

15. **Regulatory Flexibility Analysis.** As required by the Regulatory Flexibility Act of 1980, as amended (RFA) an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the NPRM to this proceeding. The Commission sought written public comment on the proposals in the NPRM, including comment on the IRFA. The Commission received no comments on the IRFA. This Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA. See 5 U.S.C. 604.

16. *Need for, and Objectives of, the Report and Order.* This document adopts rule changes to provide FM and Low-Power FM (LPFM) license applicants the option to submit computer models to verify directional antenna patterns on condition that such proof is provided

to the licensee by the antenna manufacturer.

17. Amending these rules will allow for similar treatment of directional FM stations and directional TV, DTV, and AM broadcast stations, and will eliminate unnecessary burdens on broadcasters.

18. *Summary of Significant Issues Raised by Public Comments in Response to the IRFA.* There were no comments to the IRFA filed.

19. *Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration.* Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

20. *Description and Estimate of the Number of Small Entities to Which the Rules Apply.* The RFA directs the Commission to provide a description of and, where feasible, an estimate of the number of small entities that will be affected by the rules adopted herein. The RFA generally defines the term “small entity” as having the same meaning as the terms “small business,” “small organization,” and “small government jurisdiction.” In addition, the term “small business” has the same meaning as the term “small business concern” under the Small Business Act. A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the Small Business Administration (SBA).

21. *Radio Stations.* Radio stations are an Economic Census category that “comprises establishments primarily engaged in broadcasting aural programs by radio to the public. Programming may originate in their own studio, from an affiliated network, or from external sources.” The SBA has established a small business size standard for this category as firms

having \$41.5 million or less in annual receipts. 13 CFR 121.201, NAICS code 515112 Radio Stations.

22. Economic Census data for 2012 shows that 2,849 radio station firms operated during that year. Of that number, 2,806 operated with annual receipts of less than \$25 million per year, and 43 firms had annual receipts of \$25 million or more. Because the Census has no additional classifications that could serve as a basis for determining the number of stations whose receipts exceeded \$41.5 million in that year, the Commission concluded that the majority of radio broadcast stations were small entities under the applicable SBA size standard.

23. Apart from the U.S. Census, the Commission has estimated the number of licensed commercial FM stations to be 6,763. According to BIA/Kelsey Publications, Inc.'s Media Access Pro Database, as of March 2020, 6,762 commercial FM stations had revenues of \$41.5 million or less. In addition, the Commission has estimated the number of noncommercial educational FM radio stations to be 4,119, and the number of Low Power FM (LPFM) stations to be 2,049. NCE stations are non-profit, and all LPFM stations are NCE stations, and all are therefore considered to be small entities. Accordingly, the Commission estimates that the majority of radio broadcast stations are small entities. In assessing whether a business concern qualifies as small under the above definition, however, business (control) affiliations must be included. This estimate, therefore, likely overstates the number of small entities that might be affected by the Commission's action, because the revenue figure on which it is based does not include or aggregate revenues from affiliated companies.

24. Moreover, as noted above, an element of the definition of "small business" is that the entity not be dominant in its field of operation. The Commission is unable at this time to define or quantify the criteria that would establish whether a specific radio station is dominant in its field of operation. Accordingly, the estimate of small businesses to which rules may apply does not exclude any radio station from the definition of a small business on this basis and

therefore may be over-inclusive to that extent. Also, as noted, an additional element of the definition of “small business” is that the entity must be independently owned and operated. The Commission notes that it is difficult at times to assess these criteria in the context of media entities and the estimates of small businesses to which they apply may be over-inclusive to this extent.

25. *Description of Projected Reporting, Record Keeping and Other Compliance Requirements.* The rule changes adopted in the Report and Order do not include any notification or recordkeeping requirements.

26. *Steps Taken to Minimize Significant Impact on Small Entities, and Significant Alternatives Considered.* The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.

27. The rules adopted or amended in the Report and Order, while potentially imposing new substantive requirements on FM and LPFM radio stations, are voluntary in nature, giving applicants for licensing directional FM broadcast stations the option of submitting computer models rather than submitting measured directional patterns. Applicants wishing to continue submitting measured patterns may do so; however, it is anticipated that computer modeling will save applicants money and may increase the accuracy of the directional pattern verification. Significant alternatives would include continuing to require submissions of measured FM directional antenna patterns rather than computer models; however, in the Commission’s judgment the option of submitting computer models rather than measurements

reduces financial burdens to FM stations when installing an FM directional antenna.

28. *Report to Congress.* The Commission will send a copy of the Report and Order, including the FRFA, in a report to Congress and the Government Accountability Office pursuant to the Small Business Regulatory Enforcement Fairness Act of 1996. In addition, the Commission will send a copy of the Report and Order, including the FRFA, to the Chief Counsel for Advocacy of the Small Business Administration. A copy of the Report and Order and FRFA (or summaries thereof) will also be published in the *Federal Register*.

29. **Paperwork Reduction Act Analysis.** The Report and Order may contain new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. The requirements will be submitted to the Office of Management and Budget (OMB) for review under section 3507(d) of the PRA. OMB, the general public, and other Federal agencies are invited to comment on the new or modified information collection requirements contained in this proceeding. In addition, we note that pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, see 44 U.S.C. 3506(c)(4), we previously sought specific comment on how the Commission might further reduce the information collection burden for small business concerns with fewer than 25 employees.

30. **Congressional Review Act.** The Commission has determined, and the Administrator of the Office of Information and Regulatory Affairs, Office of Management and Budget, concurs that this rule is “non-major” under the Congressional Review Act, 5 U.S.C. 804(2). The Commission will send a copy of this Report and Order to Congress and the Government Accountability Office pursuant to 5 U.S.C. 801(a)(1)(A).

ORDERING CLAUSES

31. Accordingly, IT IS ORDERED that, pursuant to the authority contained in sections 1, 4(i), 4(j), 301, 303, 307, 308, 309, 316, and 319 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 301, 303, 307, 308, 309, 316, and 319, the Report and Order IS ADOPTED and WILL BECOME EFFECTIVE 30 days after publication in the

Federal Register.

32. IT IS FURTHER ORDERED that Part 73 of the Commission's rules IS AMENDED as set forth in the Final Rules, and such rule amendments WILL BECOME EFFECTIVE 30 days after publication in the *Federal Register*, except that the rule changes to §§ 73.316 and 73.1690, which may contain new or modified information collection requirements, will not become effective until the Office of Management and Budget completes review of any information collection requirements that the Media Bureau determines is required under the Paperwork Reduction Act. The Commission directs the Media Bureau to announce the effective dates for the rule changes to §§ 73.316 and 73.1690 by subsequent Public Notice.

33. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of the Report and Order, including the Final Regulatory Flexibility Certification, to the Chief Counsel for Advocacy of the Small Business Administration.

34. IT IS FURTHER ORDERED that the Commission SHALL SEND a copy of the Report and Order in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act, see 5 U.S.C. 801(a)(1)(A).

35. IT IS FURTHER ORDERED that, should no petitions for reconsideration or petitions for judicial review be timely filed, MB Docket No. 21-422 SHALL BE TERMINATED and its docket CLOSED.

List of Subjects in 47 CFR Part 73

Communications equipment, Radio, Reporting and recordkeeping requirements, Television.

FEDERAL COMMUNICATIONS COMMISSION

Marlene Dortch,
Secretary

Final Rules

For the reasons discussed in the preamble, the Federal Communications Commission amends 47 CFR part 73 as follows:

PART 73 – RADIO BROADCAST SERVICES

1. The authority citation for part 73 continues to read as follows:

Authority: 47 U.S.C. 154, 155, 301, 303, 307, 309, 310, 334, 336, 339.

2. Delayed indefinitely, amend § 73.316 as follows:

- a. Revise paragraph (c)(2)(iii);
- b. Redesignate paragraphs (c)(2)(iv) through (ix) as paragraphs (c)(2)(v) through (x);
- c. Add new paragraph (c)(2)(iv); and
- d. Revise newly redesignated paragraph (c)(2)(x).

The revisions and addition read as follows:

§ 73.316 FM antenna systems.

* * * * *

(c) * * *

(2) * * *

(iii) A tabulation of the measured or computer modeled relative field pattern required in paragraph (c)(1) of this section. The tabulation must use the same zero degree reference as the plotted pattern, and must contain values for at least every 10 degrees. Sufficient vertical patterns to indicate clearly the radiation characteristics of the antenna above and below the horizontal plane. Complete information and patterns must be provided for angles of –10 deg. from the horizontal plane and sufficient additional information must be included on that portion of the pattern lying between + 10 deg. and the zenith and –10 deg. and the nadir, to conclusively

demonstrate the absence of undesirable lobes in these areas. The vertical plane pattern must be plotted on rectangular coordinate paper with reference to the horizontal plane. In the case of a composite antenna composed of two or more individual antennas, the composite antenna pattern should be used, and not the pattern for each of the individual antennas.

(iv) When the relative field pattern is computer modeled, as permitted in paragraphs (c)(2)(iii) and (x) of this section and in §73.1690(c)(2), the computer model must be generated by the manufacturer of the antenna, and must include a statement from the engineer(s) responsible for designing the antenna, performing the modeling, and preparing the manufacturer's instructions for installation of the antenna, that identifies and describes the software tool(s) used in the modeling and the procedures applied in using the software. It must also include a certification that the software executed normally without generating any error messages or warnings indicating an error in the program inputs. Such computer modeling shall include modeling of the antenna mounted on a tower or tower section, and the tower or tower section model must include transmission lines, ladders, conduits, appurtenances, other antennas, and any other installations that may affect the computer modeled directional pattern. The first time the directional pattern of a particular model of antenna is verified using a particular modeling software, the license applicant must submit to the Commission both the results of the computer modeling and measurements of either a full-size or scale model of the antenna or elements thereof, demonstrating reasonable correlation between the measurements achieved and the computer model results. Once a particular antenna model or series of elements has been verified by any license applicant using a particular modeling software, subsequent license applicants using the same antenna model number or elements and using the same modeling software to verify the directional pattern may submit the computer model for the subsequent antenna installation and cross-reference the original submission by providing the application file number.

* * * * *

(x)(A) For a station authorized pursuant to § 73.215 or § 73.509, a showing that the root mean square (RMS) of the measured or computer modeled composite antenna pattern (encompassing both the horizontally and vertically polarized radiation components (in relative field)) is at least 85 percent of the RMS of the authorized composite directional antenna pattern (in relative field). The RMS value, for a composite antenna pattern specified in relative field values, may be determined from the following formula:

RMS = the square root of:

$$[(\text{relative field value } 1)^2 + (\text{relative field value } 2)^2 + \dots + (\text{last relative field value})^2]$$

total number of relative field values

(B) Where the relative field values are taken from at least 36 evenly spaced radials for the entire 360 degrees of azimuth. The application for license must also demonstrate that coverage of the community of license by the 70 dBu contour is maintained for stations authorized pursuant to § 73.215 on Channels 221 through 300, as required by § 73.315(a), while noncommercial educational stations operating on Channels 201 through 220 must show that the 60 dBu contour covers at least a portion of the community of license.

* * * * *

3. Effective [INSERT 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER], amend § 73.1620 by revising paragraph (a)(3) to read as follows:

§ 73.1620 Program tests.

(a) * * *

(3) FM licensees replacing a directional antenna pursuant to §73.1690(c)(2) without changes which require a construction permit (*see* §73.1690(b)) may immediately commence program test operations with the new antenna at one half (50%) of the authorized ERP upon

installation. If the directional antenna replacement is an EXACT duplicate of the antenna being replaced (*i.e.*, same manufacturer, antenna model number, and measured or computer modeled composite pattern), program tests may commence with the new antenna at the full authorized power upon installation. The licensee must file a modification of license application on FCC Form 2100, Schedule 302-FM within 10 days of commencing operations with the newly installed antenna, and the license application must contain all of the exhibits required by §73.1690(c)(2). After review of the modification-of-license application to cover the antenna change, the Commission will issue a letter notifying the applicant whether program test operation at the full authorized power has been approved for the replacement directional antenna.

* * * * *

4. Delayed indefinitely, amend § 73.1690 by revising paragraphs (c)(2) introductory text and (c)(2)(i) through (iii) to read as follows:

§ 73.1690 Modification of transmission systems.

* * * * *

(c) * * *

(2) Replacement of a directional FM antenna, where the measured or computer modeled composite directional antenna pattern does not exceed the licensed composite directional pattern at any azimuth, where no change in effective radiated power will result, and where compliance with the principal coverage requirements of §73.315(a) will be maintained by the measured or computer modeled directional pattern. The antenna must be mounted not more than 2 meters above or 4 meters below the authorized values. The modification of license application on FCC Form 2100, Schedule 302-FM to cover the antenna replacement must contain all of the data in paragraphs (c)(2)(i) through (v) of this section. Program test operations at one half (50%) power may commence immediately upon installation pursuant to §73.1620(a)(3). However, if the replacement directional antenna is an exact replacement (*i.e.*, no change in manufacturer, antenna

model number, AND measured or computer modeled composite antenna pattern), program test operations may commence immediately upon installation at the full authorized power.

(i) A measured or computer modeled directional antenna pattern and tabulation on the antenna manufacturer's letterhead showing both the horizontally and vertically polarized radiation components and demonstrating that neither of the components exceeds the authorized composite antenna pattern along any azimuth.

(ii) Contour protection stations authorized pursuant to §73.215 or §73.509 must attach a showing that the RMS (root mean square) of the composite measured or computer modeled directional antenna pattern is 85% or more of the RMS of the authorized composite antenna pattern. *See* §73.316(c)(9). If this requirement cannot be met, the licensee may include new relative field values with the license application to reduce the authorized composite antenna pattern so as to bring the measured or computer modeled composite antenna pattern into compliance with the 85 percent requirement.

(iii) A description from the manufacturer as to the procedures used to measure or computer model the directional antenna pattern. The antenna measurements or computer modeling must be performed with the antenna mounted on a tower, tower section, or scale model equivalent to that on which the antenna will be permanently mounted, and the tower or tower section must include transmission lines, ladders, conduits, other antennas, and any other installations which may affect the measured or computer modeled directional pattern.

* * * * *